

**Extend the properties of exponents to rational exponents (Standards N.RN.1–2)**

**Standard N.RN.1:** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to show values, allowing for a notation for radicals in terms of rational exponents. *For example, we define  $5^{1/3}$  to be the cube root of 5 because we want  $(5^{1/3})^3=5^{(1/3)3}$  to hold, so  $(5^{1/3})^3$  must equal 5.*

**Concepts and Skills to Master**

- Extend the properties of integer exponents to define the meaning of rational exponents.
- Explain the meaning of rational exponents using examples such as:  $\sqrt[3]{x^2}=(x^2)^{1/3}=x^{2/3}$

**Related Standards: Current Course**[II.N.RN.2](#), [II.A.REI.4](#), [II.A.SSE.1b](#), [II.A.SSE.2](#), [II.A.SSE.3c](#), [II.F.IF.8b](#)**Related Standards: Future Courses**[III.A.SSE.2](#), [III.A.REI.2](#), [III.F.BF.4](#), [III.F.IF.7e](#), [III.F.IF.8](#), [P.F.BF.4](#)**Support for Teachers****Critical Background Knowledge**

- Properties of integer exponents ([8.EE.1](#))
- Work with radical and integer exponents ([8.EE.1-4](#))

**Academic Vocabulary**rational exponent, radical, radicand, index,  $n$ th root**Resources:**[Curriculum Resources](#): <https://www.uen.org/core/core.do?courseNum=5620#71464>

Extend the properties of exponents to rational exponents (Standards N.RN.1–2)	
<b>Standard N.RN.2:</b> Rewrite expressions involving radicals and rational exponents using the properties of exponents.	
Concepts and Skills to Master	
<ul style="list-style-type: none"><li>Translate fluently between radical and exponential forms using properties of exponents.</li></ul>	
Related Standards: Current Course	Related Standards: Future Courses
<a href="#">II.RN.1</a> , <a href="#">II.A.SSE.1b</a> , <a href="#">II.A.SSE.2</a> , <a href="#">II.A.SSE.3c</a> , <a href="#">II.A.REI.4</a> , <a href="#">II.F.IF.8b</a>	<a href="#">III.A.APR.7</a> , <a href="#">III.A.SSE.2</a> , <a href="#">III.A.REI.2</a> , <a href="#">III.F.IF.7e</a> , <a href="#">III.F.IF.8</a>

## Support for Teachers

Critical Background Knowledge
<ul style="list-style-type: none"><li>Properties of integer exponents (<a href="#">8.EE.1</a>)</li><li>Work with radical and integer exponents (<a href="#">8.EE.1-4</a>)</li><li>Know the relationship between radical notation and rational exponent notation (<a href="#">II.N.RN.1</a>)</li></ul>
Academic Vocabulary
rational exponent, radical, radicand, index, <i>n</i> th root
Resources:
<a href="#">Curriculum Resources</a> : <a href="https://www.uen.org/core/core.do?courseNum=5620#71465">https://www.uen.org/core/core.do?courseNum=5620#71465</a>

Use properties of rational and irrational numbers (Standard N.RN.3).

**Standard N.RN.3:** Explain why sums and products of rational numbers are rational, that the sum of a rational number and an irrational number is irrational, and that the product of a nonzero rational number and an irrational number is irrational. Connect to physical situations (e.g., finding the perimeter of a square of area 2).

#### Concepts and Skills to Master

- Explain why adding and multiplying two rational numbers results in a rational number.
- Explain why adding a rational number to an irrational number results in an irrational number.
- Explain why multiplying a nonzero rational number to an irrational number results in an irrational number.
- Define closure with an operation, and apply closure to the addition of two rationals and two irrationals and multiplication of two rationals.
- Explore whether closure applies when multiplying two irrational numbers, such as  $\sqrt{2}$  times  $\sqrt{8}$ .
- Supply examples and counter-examples of properties.

#### Related Standards: Current Course

[II.N.RN.1](#), [II.N.RN.2](#), [II.A.APR.1](#), [II.A.SSE.2](#), [II.A.SSE.1b](#), [II.A.SSE.3](#),  
[II.F.BF.1b](#)

#### Related Standards: Future Courses

[III.A.APR.1](#), [III.A.APR.7](#), [III.A.REI.2](#), [III.A.SSE.1b](#), [III.A.SSE.2](#),  
[III.A.SSE.4](#), [III.F.BF.1b](#)

### Support for Teachers

Critical Background Knowledge
<ul style="list-style-type: none"><li>• Know that numbers that are not rational are called irrational (<a href="#">8.NS.1</a>)</li><li>• Use rational approximations of irrational numbers (<a href="#">8.NS.2</a>)</li><li>• Understand how to perform operations and simplify radicals (<a href="#">8.NS.3</a>)</li></ul>
Academic Vocabulary
rational, irrational
Resources:
<a href="https://www.uen.org/core/core.do?courseNum=5620#71467">Curriculum Resources</a> : <a href="https://www.uen.org/core/core.do?courseNum=5620#71467">https://www.uen.org/core/core.do?courseNum=5620#71467</a>